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# VETERINARY JOURNAL

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FEBRUARY, 1938

## Obituary

## THOMAS FRANCIS QUIRKE, M.R.C.V.S., I.V.S.

THE Indian Civil Veterinary Department has received a severe blow by the unexpected death, from pneumonia following influenza, of Mr. T. F. Quirke, one of its senior officers, who was the Chief of the Veterinary Service in the Province of The Punjab. Graduating from the Irish College in 1912, keen and up-to-date in the administration of the scientific methods used for the control of epidemics which occur in India to an extent which can scarcely be realised in England, Mr. Quirke was not only a successful, but also a tactful and popular administrator, whose instructions were carried out efficiently and willingly. His staff knew that they had in him not only a capable advisor but a real friend. His loss will be especially felt at the present moment as owing to the policy of Indianisation of all the Services, there has been no recruiting from England in recent years, and an exceptionally high proportion of officials in the higher branches of the Veterinary Service are due to retire.

Mr. Quirke was one of the few to be left behind, upon whose shoulders greater responsibility would have rested to pilot the ship until the new system had got into its stride—and his untimely death makes the gap a wide one and difficult to bridge. An appreciation by Professor Aggarwala, of the Lahore Veterinary College, will be found on page 50.

The sympathies of the profession will be given to his wife and family.

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# THE LATE MR. T. F. QUIRKE, M.R.C.V.S., I.V.S.,

*Director of Veterinary Services, Punjab*

## AN APPRECIATION by Professor A. C. AGGARWALA

THE entire veterinary profession in India have learnt, with deep regret and profound sorrow, of the sad and untimely death from pneumonia of Mr. Thomas Francis Quirke, M.R.C.V.S., I.V.S., Director of Veterinary Services, Punjab, which occurred at the Albert Victor Hospital, Lahore, after a brief illness, on Thursday, January 13th, 1938.

Born on 6th June, 1891, at Tipperary, Ireland, the deceased, after a preliminary education at the Clongowes Wood College, Sallins, from 1905 to 1909, joined the Royal Veterinary College, Ballsbridge, Dublin, and received his Diploma of M.R.C.V.S. in 1913. Soon after qualifying as a Veterinary Surgeon, he was engaged in private practice with Mr. Hamilton, M.R.C.V.S., at Ballina, for about a year before being appointed to the Veterinary Staff of the Irish Department of Agriculture and Technical Instruction. Mr. Quirke came out to India in February, 1915, having been appointed to the Indian Civil Veterinary Department, now known as the " Indian Veterinary Service." He served for some five years as a Superintendent in this Department at Ferozepur and Rawalpindi. In March, 1920, he was promoted to the post of Chief Superintendent in succession to the late Lt.-Col. Farmer. In 1928, when the Veterinary Department was separated from the Agricultural Department, he was appointed Director of Veterinary Services in the Punjab, and continued to hold this post until his death. He had thus been at the helm of veterinary affairs in the Punjab Province for nearly 18 years. As the Punjab Government Appreciation stated, " During this period the Veterinary Department of the Province has attained a growth and a fame unparalleled in India, and a large share of this success was due to Mr. Quirke's unstinted efforts, wide knowledge and unfailing enthusiasm." The statistics given below show the progress made by the Department under the control of Mr. Quirke at the time he assumed charge as Chief Superintendent in 1920 and up to the time of his death:

| | 1919–20 | 1937–38 |
|---|---|---|
| No. of Veterinary Hospitals in Punjab | 137 | 304 |
| No. of Outlying Dispensaries ... | — | 1,200 |
| No. of Stud-bulls ... ... ... | 1,352 | 5,370 |
| No. of Cattle Fairs and Shows held ... | 35 | 252 |
| Strength of non-gazetted Staff employed in District work ... ... ... | 192 | 393 |
| Strength of gazetted Staff employed... | 15 | 36 |
| Expenditure of the Department ... | Rs. 2,147,531 | Rs. 2,147,472 |

In the death of Mr. Quirke in the prime of his life when only a little over 46 years of age, the Veterinary Profession in India has lost an outstanding member of long experience, great personality and forcefulness at a time when he was most needed. Having specialised in the peculiar problems of India appertaining to the control of contagious diseases of animals, improvement of indigenous breeds of livestock and general animal husbandry matters, he best understood the difficulties of the profession, and was always out to lend a helping hand and valuable advice to both officials and private persons. The magnitude of his loss to the country as a whole, and to the Punjab in particular, will be realised by those who knew him and who had the privilege of working with and under him. His diligent dutifulness, soundness of judgment, unassuming nature, simplicity of habits and outspoken criticism, coupled with real kindliness and general sympathetic behaviour will long be remembered by all with whom he came in contact either in his official capacity as the head of the Veterinary Department in Punjab or as a private individual. As an administrator he commanded respect and his opinion in technical matters was greatly valued.

"Tom," as Mr. Quirke was affectionately called by his many personal friends, was a well-known and popular figure in Lahore society and was closely connected with the Lahore Race Club, where, for a number of years, he assisted as a Veterinary Officer and as a Timekeeper. His memory will ever remain in the hearts and minds of the people of the Punjab Province for whose sake he was always engaged in hard and enduring work.

**Funeral**

The funeral took place on Friday, January 14th, at the Jail Road Cemetery, Lahore. It was largely attended by European and Indian friends of the late Mr. Quirke. Among those present were His Excellency the Governor of the Punjab, Sir Herbert Emerson; Chaudhari Sir Chhotu Ram, Development Minister of the Punjab Government; Mr. Justice Skemp; Mr. Justice Monroe; the Chief Secretary to the Punjab Government; Mr. A. C. Macnabb; Professor Roberts; Mr. C. C. Garbett; Mr. A. V. Askwith; Capt. U. W. F. Walker and a number of civil and military officers besides the staff of the Veterinary Department and students of the Punjab Veterinary College. The Premier of the Punjab was represented by his Private Parliamentary Secretary.

The cortege reached the cemetry at 5 p.m. by which time the Governor and others had already assembled outside the cemetery. The pall-bearers, namely, Messrs. Garbett, Askwith, Dodd, Walker, Creaner, Glover and Lt.-Col. Langdale, lifted the coffin and carried it to the grave, the mourners following in procession. The funeral service was read by the Rev. Father Sulvanus, assisted by another Church dignitary.

Among the innumerable wreaths were those from Sir Herbert and Lady Emerson, the Bishop of Lahore, Sir Douglas Young, Mr. Justice Skemp, Lt.-Col.

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Carson, Lt.-Col. and Mrs. G. H. Langdale, Mr. and Mrs. H. R. Stewart, Mr. R. J. S. Dodd, Mr. and Mrs. E. M. Atkinson, Mr. C. C. Garbett, Mr. and Mrs. W. N. P. Jenkin, Mr. Justice and Mrs. H. A. C. Blacker, Mr. and Mrs. Guest, Major J. T. Taylor, Mr. J. C. F. Davidson, Lt.-Col. and Mrs. Wordsworth, Capt. U. W. F. Walker, Professor A. C. Aggarwala, Lala Ram Rattan Puri, Capt. Teja Singh, the Personal Staff of H.E. the Governor, Members of the Teaching Staff of the Punjab Veterinary College, the Punjab Veterinary Association, Members of the Staff of the Office of the Deceased, Members of the Punjab Club, the Stewards of the Lahore Race Club, the Commandant and Officers of the 6th D.C.O. Lancers, Officers of the Irrigation Department and Students of the Veterinary College.

The principal mourners were: Mrs. Quirke and Miss Mira Quirke, Capt. and Mrs. Ross, Mr. and Mrs. Farquharson and Mr. Dundon. **A.C.A.**

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# Editorial

## FORMATION OF A SECTION OF COMPARATIVE MEDICINE IN INDIA

THE recent invitation issued by the Indian Association of Science to send a deputation of delegates from the British Association of Science to be present and take part in their Jubilee Congress at Calcutta has, incidentally, proved of great value to the veterinary profession in India, as it gave the opportunity to establish a liason between human and veterinary medicine and to greatly strengthen the relationship (which already, to some extent, existed) between Veterinary Hygiene and Preventive Medicine and Animal Husbandry; for which our distinguished colleagues, Colonel Sir Arthur Olver, the Animal Husbandry Expert of the Imperial Council of Agricultural Research in India, Mr. Frank Ware, the Director of the Muktesar Laboratory, and the Directors of Veterinary Services of the respective Provinces, are so largely responsible.

The Indian Association of Science is a very influential Body and the formation of a permanent section of Comparative Medicine (which was enthusiastically received) cannot but be for the mutual good for each branch of Medicine—the human and the animal. It will be built up on much the same lines as is that of the Royal Society of Medicine of London, and all graduates in Medical or Veterinary Science are eligible for membership.

## THE POULTRY INDUSTRY AND DISEASE WASTAGE

FOR some years the Poultry Industry has been declining, both in value and in the number of its supporters, and it had become obvious that if nothing was done to check the losses from disease nothing but ruin could ensue. Its national value is estimated at thirty millions of pounds annually and the losses, mainly from bad husbandry and disease, at £110,000, much of which is preventable. Yielding to urgent pressure a Poultry Technical Committee, under the Chairmanship of Sir Duncan Watson, was set up by the Government some months ago and the results of their findings have recently been published in a White Paper, which can be obtained for 1s. 2d. post free, from the Stationery Office. In this is summarised the results of their investigations into the methods at present used in dealing with eggs, day old chicks, breeding stock, and other things pertaining to the Industry; together with an emphasis upon the great losses caused by the ravages of disease; and the urgent conclusion is expressed that radical methods must be taken at once if the industry is to be preserved.

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It is strongly advised that a Poultry Stock Improvement Commission for Great Britain shall be appointed by the Ministry of Agriculture, and the Secretary of State for Scotland, with Advisory Committees for each of these countries, and for Wales; and that a compulsory system of registration and control shall be established everywhere. More research laboratories, which have for some time been urgently needed, are to be established to work at Poultry Diseases, and officers are to be appointed for educational and advisory work.

The total cost of the scheme recommended is about £110,000 annually; and, although this appears a big sum it is very small when statistics show that the loss from disease alone (as estimated by the National Veterinary Medical Association) is over £4,000,000 a year for adult birds in England and Wales alone.

The problem is of vital interest to agriculture and if only the money can be found to efficiently equip and endow research, the workers can readily be found amongst the ranks of those who are best fitted to carry it out, i.e., the members of the Veterinary profession.

## THE 13th INTERNATIONAL VETERINARY CONGRESS

In the preliminary brochure of the 13th International Veterinary Congress, which is to take place in Switzerland in the forthcoming August, it is announced that the Proceedings will be held in Zurich from Sunday, August 21st to the evening of Wednesday, 24th; and will be resumed at Interlaken on Friday, 26th, concluding here on Saturday, 27th.

The ordinary Membership Subscription is 30 Swiss Francs, with the privilege of tickets for ladies or other family members at 5 francs each. For Veterinary students the cost is only 15 francs.

The subjects for discussion are numerous and varied enough to suit every form of Veterinary study; and the essayists who have been selected to present papers on the various subjects are specialists and research workers whose names are known internationally. A complete list together with all particulars regarding travelling facilities and lists of hotels can be obtained upon application to the Secretary for the British Section, c/o The National Veterinary Medical Association, 36, Gordon Square, London, W.C.1.

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## General Articles

# THE DIAGNOSIS OF POULTRY DISEASES IN THE FIELD BY THE VETERINARY PRACTITIONER

By W. P. Blount, F.R.C.V.S.
*Chief Veterinary Officer to the East Sussex County Council*

In view of the proposed attack which may be made in the near future by veterinarians on poultry disease problems, it is perhaps appropriate that a review of the practitioner's standpoint relative to diagnosis be made.

It is generally felt that poultry work necessitates elaborate laboratory investigations, but it is hoped to produce in this article evidence to show that a considerable proportion of cases can be dealt with direct in the field. Further, with the intelligent use of the microscope at least 60% of all poultry cases can be dealt with without laboratory assistance.

It follows, therefore, when a veterinary surgeon has made himself fully acquainted with the findings which are encountered *post-mortem* in poultry, and at the same time knows the essentials of poultry husbandry, he should be able to deal direct with more than half the cases usually sent to laboratories.

However, it should be clearly understood that a knowledge of the farmers' methods of management, and the history of the outbreak concerned will frequently be of considerable aid in the rapid field diagnosis of poultry disease work. *Post-mortem* findings alone must not be counted upon to give the solution to every disease problem dealt with in the field, for a knowledge of poultry farming practices and of the symptoms which may accompany illnesses are also important.

A survey of some 2,000 cases dealt with by the writer during the year 1935-36 at the Poultry Health Laboratories, St. Leonards-on-Sea, has elicited a number of interesting facts, but first the following points should be noted.

It is convenient to group poultry diseases, based solely on *post-mortem* findings, under the following headings:

(1) *Conditions clearly recognisable* without the use of the microscope, and for which diagnosis no bacteriological, histological, or biological examinations are required, e.g. Blackhead, Visceral Gout.

(2) *Disease conditions easily recognisable* but for definite purposes of *confirmation* the following examinations are required:

(*a*) a microscopic examination is required, e.g., Tuberculosis, chick Coccidiosis (with cæcal hæmorrhage).

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(*b*) a bacteriological examination is necessary, e.g., certain clear cut cases of B.W.D., Aspergillosis, Fowl Typhoid.

(*c*) a histological examination may be necessary, e.g., Fowl Paralysis, Leukæmia.

(*d*) a biological examination may be required, e.g., Fowl Pox, Infectious Laryngo-Tracheitis.

(3) Cases which show *post-mortem* features suggestive of certain diseases, but which require additional examinations for confirmatory purposes only, e.g., certain cases of Coccidiosis, B.W.D., Davaineiasis, Fowl Paralysis.

(4) Cases which at *post-mortem* examination show no clear cut features, but following microscopic or laboratory examinations (bacteriological or biological) give definite results, e.g. Typhoid, Fowl Cholera, etc.

(5) Certain cases which appear definite at the preliminary *post-mortem* examination (e.g., chill) but which require additional examinations relative to important conditions, such as B.W.D.; or e.g., Fowl Paralysis, which requires a microscopic examination to determine whether infestations of internal parasites are an important complicating factor, and liable by themselves to be causing trouble to in-contact poultry.

(6) Cases where *post-mortem* features are indefinite and microscopic and bacteriological examinations uncertain, e.g., *post-mortem* suggestive of chill, micro. reveals few coccidia and bact: B. coli.

Thus it follows individual outbreaks of specific disease may require simple or elaborate methods for diagnosis. For example *Bacilliary White Diarrhœa* in chicks, in many cases, may easily be recognised post-mortem by the lesions presented—together with a study of the available flock history. Other cases of the same disease require bacteriological examinations, not only for confirmatory purposes, but in addition to prove whether any yolk sacs present contain the causal organisms—thus to prove the hereditary nature of the disease. Then again, a small proportion of outbreaks are revealed only because bacteriological examinations disprove the suggestion that the losses are due solely to errors of management on the farm—so-called "chill." (The post-mortem features in these cases showing little that is specific for B.W.D.)

Nevertheless, a careful study of the diseased organs seen after death in Bacilliary White Diarrhœa shows features in affected chicks which may be considered of value in diagnosis, thus:

| | |
|---|---|
| Post-mortem findings typical or highly suggestive | 85% |
| Post-mortem findings suggestive ... ... ... | 12% |
| Post-mortem findings negative ... ... ... | 3% |

TYPICAL CASES.

| | | |
|---|---|---|
| Lesions involving | liver ... ... ... ... | 66% |
| ,, ,, | lungs ... ... ... ... | 66% |
| ,, ,, | liver and lungs ... ... ... | 40% |
| ,, ,, | the kidneys ... ... ... | 51% |
| ,, ,, | cæcal pus ... ... ... | 36% |
| ,, ,, | the heart ... ... ... ... | 33% |
| ,, ,, | the yolk sacs ... ... ... | 20% |

**Tuberculosis.**

In this disease, there are also cases readily recognised post-mortem which for practical purposes require no demonstration of acid fast bacilli. On the other hand there are also lesions of the liver or spleen which suggest tubercle infection but without the use of a microscope cannot be clearly identified.

The following statistics have been culled from the records indicated above:

BREEDS.

| | |
|---|---|
| Rhode Island Red ... ... ... ... ... | 66% |
| Lt. Sussex, W. Wyandotte, and W. Leghorn ... | 24% |
| Remainder ... ... ... ... ... ... | 10% |

MORTALITY.

Average 20% (5%—50%)
3 worst months—December, January, February.
3 best months—June, July, August.

AGE.

Average age of affected birds, 14 months.

| | |
|---|---|
| Over 12 months ... ... ... ... ... | 55% |
| Under 1 year ... ... ... ... ... | 45% |
| Over 18 months ... ... ... ... ... | 14% |
| Under 9 months ... ... ... ... ... | 16% |

SEX.

| | |
|---|---|
| Females ... ... ... ... ... ... ... | 98% |
| Males ... ... ... ... ... ... ... | 2% |

SYMPTOMS.

| | |
|---|---|
| Lameness (or loss of use of legs) and emaciation (having gone "light") ... ... ... ... | 66% |
| Diarrhœa ... ... ... ... ... ... | 16% |
| Blindness ... ... ... ... ... ... | 9% |
| Sudden death ... ... ... ... ... ... | 9% |

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**Coccidiosis.**

Here, too, there are many varieties of cases, some of which require microscopical confirmation—especially if visible lesions of the gut are absent. Further, in per acute cases (without intestinal hæmorrhage) myriads of merozoites may be seen, and few, if any, oocysts.

As a result of the above points, the veterinarian in the field is often in a position to say to the farmer concerned, " From this examination I am definitely of the opinion that your birds are suffering from so-and-so, therefore, the precautions we must take are as follows. However, to confirm this, I must take two or three ailing birds away for further examinations, and I will let you know the results of these in due course." Such a step inspires the poultryman's confidence in the practitioner, gives the latter an opportunity to carry out additional tests at his surgery, or alternatively, to send birds away to a laboratory. It also ensures that adequate protection to the rest of the flock is given.

A summary of the 2,000 outbreaks referred to earlier in this article has shown that:

In 30% of cases it was possible to make a diagnosis based on the post-mortem and clinical findings alone.

In 62% of cases diagnosis was satisfactory, providing microscopic findings were also available.

In 32% of cases a diagnosis could not be made unless bacteriological examinations were carried out.

Biological examinations were necessary in an additional 2% of instances.

Unsatisfactory results (even after making full use of all laboratory facilities available) were less than 4% of the total.

The following case shows the complexity of some of the field problems, and the necessity for a knowledge of poultry husbandry additional to that of pathology:

**Rickets.**

A farmer complained that his 6-10 week old chicks were ailing and thought to be suffering from Rickets. Three chicks had been sent to a proprietary food firm's laboratory and were diagnosed as suffering from Rickets, complicated by cæcal Coccidiosis. The farmer was using food X—a concentrate—as his antirachitic factor, no Cod Liver Oil or other vitamin concentrate being available for the chicks. The season of the year being mid-winter, little direct sunshine was available for vitamin D formation. Chicks reared both indoors and outside were equally affected, and at the time of the advisory visit paid by the writer the food X was clearly under suspicion—about 5% of the chicks had died.

The four cardinal features of Rickets in chicks are (1) Rubber beak, (2) Enlargement of the parathyroid glands, (3) Deformities of the ribs and/or their cartilages, (4) The improper calcification of the long bones.

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Fifteen post-mortem examinations of representative birds were made and these revealed varying degrees of true Rickets in the youngest chicks, together with signs and symptoms of acute hypocalcæmia in the older birds. The beaks and ribs of the latter were relatively normal, but recent calcification of the long bones was delayed and irregular, and there was marked enlargement of the parathyroid glands. Clinically, the birds were staggering and tending to squat on the ground. A number of these birds were also affected with sub-acute Coccidiosis.

The manufacturers of the concentrate X indicated in their literature that 20% was the usual quantity to be incorporated in chick mashes, and in addition, they gave a suggested formula. This did not contain bran, which is a popular and favourite ingredient with many poultry farmers, so the gentleman in question decided to incorporate 15% of *broad* bran in the ration. He also fancied skim milk for his chicks, so replaced 5% of X by this (for the young chicks) and for his older birds the X was further reduced by the inclusion of 5% fish meal—considered essential as an animal protein product. Finally, after using this formula apparently satisfactorily for two months, the farmer reduced the original 20% of X to only 15%, and although the supply of skim milk was then no longer available, he failed to replace this with any other product.

Bran is palatable to many chicks and the *broad* variety particularly easily picked out of a mash. Bran is deficient in calcium and rich in phosphates. Skim milk is relatively rich in minerals and may provide a small amount of vitamins A or D. Presumably, concentrate X fed as 20% of the mash ration contains adequate protection against Rickets (otherwise the preparation could not maintain its existence on the poultry market) but there could obviously be no guarantee that it would be effective if only 10%—15% were used.

Presumably, in the case under discussion, Rickets was prevented whilst skim milk was available and the broad bran eaten in normal quantities. However, in the absence of the former, coinciding with the reduction in X from 20% down to 15%, possibly further complicated by mineral imbalance due to the broad bran, or Coccidiosis, so Rickets was produced.

These observations do not prove that X may not have been deficient in its vitamins.

Obviously, the proof necessary to show that the concentrate X did have its full complement of vitamins A and D, and calcium or phosphorous, resolves itself into a series of feeding experiments, but at the time of writing the farmer concerned appreciates the errors he has made, and an amicable settlement with the company will probably follow.

A number of cases of true Rickets *independent* of Coccidiosis were observed in the young chicks, so that the place of the latter was not considered of primary importance in this investigation, but with the older birds the problem was obviously more complicated, as indicated above.

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# OBSERVATIONS ON THE BACTERIAL FLORA OF THE INTESTINE OF NORMAL SHEEP

**By P. S. WATTS, Ph.D., B.Sc., M.R.C.V.S., Dip.Bact.**
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## Introduction

THE literature contains very few records of the bacterial flora of the intestine of normal sheep. In view of the fact that this animal appears to be particularly susceptible to certain intestinal diseases it seemed desirable to obtain some information concerning the types and numbers of bacteria normally present in its intestine. It was not possible, in the time available, to carry out a detailed study of all the various types encountered, and it was decided to aim as far as possible, at obtaining information of a general nature regarding the state of the flora at different levels throughout the bowel.

Only one general survey relating to animals other than dogs was found in the literature. This was an article by Tunnicliff (1932) in which he described his analysis of intestinal contents of nine lambs from 15 to 74 hours old. He found that the flora consisted of *Bact. coli*. *Cl. welchii* and a diplococcus and that, numerically, the duodenal count varied from none to few, the ileal from few to many, and the caecal was invariably high. Some of his strains of *Cl. welchii* were examined by Marsh, Tunnicliff and Jungherr (1932) who reported them as non-toxic.

Gaiger (1924) stated, without giving the actual evidence, that *Cl. septique* and *Cl. welchii* were constant inhabitants of the intestines of herbivora. Oxer (1932) from his experience of entero-toxæmia, suggested that *Cl. welchii* (*ovitoxicum*) is probably present in the intestines of normal lambs. Bennetts (1932) found this type of *Cl. welchii* in the cæcum and abomasum of healthy sheep during an entero-toxæmia outbreak, but these were probably "contact" animals and cannot therefore be regarded as strictly normal sheep.

Piening (1932), working with dried intestines, tested 20 sheep from various parts of the world and identified the following organisms:

| | | | | | |
|---|---|---|---|---|---|
| Cl. welchii | ... | ... | in 100 | per cent. | of cases |
| Cl. oedematiens | ... | | ,, 80 | ,, | ,, |
| Cl. septique | ... | ... | ,, 15 | ,, | ,, |
| Cl. histolyticum | ... | | ,, 5 | ,, | ,, |
| Cl. sporogenes | ... | | ,, 65 | ,, | ,, |
| Cl. bifermentans | ... | | ,, 90 | ,, | ,, |
| Cl. tertium | ... | ... | ,, 45 | ,, | ,, |
| Cl. sphenoides | ... | | ,, 15 | ,, | ,, |
| Cl. multifermentans | ... | | ,, 85 | ,, | ,, |
| Cl. tetanomorphum | ... | | ,, 5 | ,, | ,, |
| Cl. tetani | ... | ... | ,, 25 | ,, | ,, |
| Cl. lichnoides | ... | ... | ,, 10 | ,, | ,, |

Four of the sheep were from England (districts unspecified) in which he found:

| | | |
|---|---|---|
| Cl. welchii | ... ... | in 4 cases |
| Cl. oedematiens | ... | „ 4 „ |
| Cl. septique | ... ... | „ 3 „ |
| Cl. multifermentans | ... | „ 3 „ |
| Cl. sporogenes | ... | „ 2 „ |
| Cl. bifermentans | ... | „ 2 „ |
| Cl. tetanomorphum | ... | „ 1 „ |
| Cl. tertium | ... ... | „ 1 „ |
| Cl. tetani | ... ... | „ 1 „ |

Many other reports on the intestinal flora of man and animals have been consulted and are recorded in the bibliography appended together with a brief note of their contents.

The following general conclusions regarding the normal flora, especially in the case of human beings, appear to have been fully established:

1. There are but few aerobes and few or no anærobes in the upper part of the small intestine.
2. The organisms present there are mainly cocci.
3. *Bact. coli.* increases in numbers both absolutely and relatively as the ileum is approached and is there the predominant organism.
4. A few gram-positive aerobic bacilli are present in the small intestine.
5. The composition of the fæcal flora is influenced by age, diet and locality.

Any instances in which the facts established in the case of man have proved of interest for comparison with the findings obtained in sheep have been considered in the relevant sections of this paper.

### Material examined.

The sheep used in this investigation were normal animals slaughtered for human consumption and coming, as far as could be ascertained, from Cambridgeshire and Leicestershire. Although they had been fasted for some hours before being killed, the intestines were never devoid of contents.

Immediately after death, the intestines were removed and samples of their contents taken from the first six feet of the small intestine, the penultimate six feet of the ileum, the cæcum, the middle of the colon and the rectum. In the first few cases material was also taken from the jejunum but the amount collected was so small that it was later omitted. The intestines were seared with a hot iron, cut with a sterile knife and the contents expelled into 100 c.c. sterile bottles. These were then taken to the laboratory and dealt with immediately by various methods designed to demonstrate the number and types of organisms present.

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### Estimation of the Hydrogen Ion Concentration.

In a series of 25 sheep the hydrogen ion concentration of the various samples was also determined as it was desired to ascertain if any considerable variation occurred in the normal animal, such as might possibly influence the character of the bacterial flora. Owing to the nature of the material to be examined it was found impossible to obtain reasonably accurate results by the use of either colorimetric methods or of the hydrogen electrode. With the former, readings were difficult owing to the colour of the contents, whilst the use of hydrogen caused an excessive amount of frothing. It was, therefore, decided to employ the double quinhydrone electrode in making the determination.

No preliminary treatment of the samples from the duodenum and ileum was necessary but the remainder were first diluted with an equal quantity of distilled water. Such dilution can hardly have affected the readings to any appreciable extent as it was found that further dilution to one in four gave a variation of pH. 0.02 only.

The figures obtained for the 25 sheep examined were as follows:

| | Average. | Maximum. | Minimum. |
|---|---|---|---|
| Duodenum ... ... | 6.46 | 6.81 | 6.25 |
| Ileum ... ... ... | 7.65 | 8.17 | 7.01 |
| Cæcum ... ... ... | 7.52 | 8.21 | 7.01 |
| Colon ... ... ... | 7.77 | 8.31 | 7.31 |
| Rectum ... ... ... | 8.00 | 8.41 | 7.60 |

It will be seen that in this series of animals the reaction did not vary greatly in any case from the mean figures, as set out above, and hence there appeared to be no possibility of studying the influence of changes in pH. values on the character of the bacterial flora. Since the variations were so small, the averages obtained may be regarded as indicating approximately the normal reactions, although the number of sheep was not very large. It was, however, considerably greater than other series for which figures are available. The latter may be included for purposes of comparison and are as follows:

| | Number of sheep examined. | pH values | | |
|---|---|---|---|---|
| | | Duodenum. | Ileum. | Large Intestine. |
| Long and Fenger (1917) ... | 3 | 6.42 | 7.76 | |
| Ferber (1928) ... ... ... | 1 | 5.80 | 7.80 | 8.4 |
| Gilbert (1934) ... ... | "A small number" | | 7.6—8.4 (Mixed contents of small intestines.) | |
| Bennetts (1932) ... ... | 2 | | 6.15 and 7.12 | |

## AEROBIC FLORA.

Smears of the material revealed the presence of cocci, gram-positive and gram-negative bacilli.

### Quantitative Examination.

Estimations were carried out volumetrically by adding 5 c.c. of the intestinal contents to sterile tap water. In the case of the cæcum, colon and rectum a

sterile measuring cylinder was used and the volume of water noted before and after the addition of the intestinal material. Roll tubes (Wilson, 1922) and plates were used for enumeration. The tubes and plates were inoculated by means of calibrated Pasteur pipettes and graduated pipettes respectively, all inoculations being in duplicate. More complex media having failed to yield any greater number of colonies, nutrient agar was used together with Brom-Thymol-Blue medium (Burke-Gaffney (1932)) for the differentiation of *Bact. coli*. The number of colonies was noted after 48 and 96 hours incubation at 37°C.

By these methods samples from the duodenum, ileum and cæcum of 21 sheep were examined. The colon and rectum were included in the first few cases only, as it soon became apparent that, whilst the flora of these parts of the intestine was of the same general type as that of the cæcum, it included an increased proportion of members of the Bacillus group, the spreading growths of which rendered even approximate enumeration of colonies, either on roll tubes or plates, impossible.

The figures of both roll tube and agar plate counts (Table I) represent the number of viable organisms capable of growth on agar. These counts are, in effect, duplicates and agree very closely within the limits of experimental error. The divergence between the different sheep is rather too great for any actual mean value to be given, but from these observations it may be concluded that in normal sheep it is usual for the aerobic bacteria to number less than $1 \times 10^6$ per c.c. in the duodenum, between $1 \times 10^6$ and $10 \times 10^6$ in the ileum, and between $10 \times 10^6$ and $45 \times 10^6$ in the cæcum.

In the table reference is made to " Brom-thymol-blue Plates," the number of yellow colonies present being shown, and by comparing this number with that given in the column headed " Agar plates " the percentage of *Bact. coli.* is obtained. This percentage varies so greatly that there would seem to be no fixed proportion between the number of *Bact. coli.* and that of other organisms.

Colonies of organisms other than *Bact. coli.* were not present throughout the series in sufficient numbers to enable their relative proportions to be assessed. There was evidence, however, that the relative number of cocci was highest in the upper parts of the intestines, and that of the bacillus group in the lower.

### Qualitative Examination.

All roll tubes and agar plates were examined and a colony of each type picked off and inoculated into tubes of broth. The resulting culture was incubated for 24 hours and then plated on agar. Representative colonies of all types present were removed and again inoculated into broth. This procedure was repeated until the cultures appeared pure when their general properties were investigated.

The results of the examination of various parts of the intestine of 20 sheep are given in Table II. It will be seen that the duodenum usually contains *Bact.*

TABLE I.

SHOWING THE NUMBERS OF BACT. COLI. AND OTHER AEROBIC BACTERIA PRESENT IN THE INTESTINES.

| Shee | Duodenum. | | | | Ileum. | | | | Caecum. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Roll Tubes. | Agar Plates. | BTB Plates. | % Coli. | Roll Tubes. | Agar Plates. | BTB Plates. | % Coli. | Roll Tubes. | Agar Plates. | BTB Plates. | % Coli. |
| 1. | 0 | | | | 0.1 | | | | 0.25 | | | |
| 2. | 0.12 | | | | 26.0 | | | | 42.0 | | | |
| 3. | 0.15 | | | | 1.2 | | | | 8.0 | | | |
| 4. | 0.6 | | | | 0.8 | | | | — | | | |
| 5. | 0.02 | | | | 6.0 | | | | 24.5 | | | |
| 6. | 0.83 | 1.2 | | | 13.0 | 13.2 | | | 42.0 | 54.0 | | |
| 7. | 0.7 | 0.55 | 0.44 | 80 | 8.0 | 7.5 | 6.2 | 83 | 22.6 | 20.0 | 15.0 | 75 |
| 8. | 5.0 | 3.0 | 2.8 | 93 | 17.0 | 19.0 | 14.0 | 69 | 14.0 | 15.5 | 10.9 | 70 |
| 9. | 0.19 | 0.14 | 0.08 | 57 | 1.6 | 1.1 | 0.9 | 82 | 12.0 | 11.0 | 7.5 | 68 |
| 10. | 0.8 | 0.9 | 0.7 | 88 | 7.0 | 9.0 | 7.0 | 88 | 16.0 | 14.0 | 10.6 | 76 |
| 11. | 0.28 | 0.31 | 0.29 | 93 | 4.5 | 5.4 | 4.9 | 87 | 13.5 | 13.3 | 10.5 | 79 |
| 12. | 0.02 | 0 | 0 | — | 0.8 | 0.9 | 0.3 | 33 | 1.6 | 1.4 | 0.6 | 43 |
| 13. | 0.7 | 0.57 | 0.61 | 100 | 1.5 | 1.4 | 1.4 | 100 | 21.0 | 19.0 | 15.2 | 70 |
| 14. | 0.07 | 0.26 | 0.17 | 65 | 3.9 | 1.2 | 3.6 | 100 | 2.6 | 4.0 | 3.7 | 92 |
| 15. | 0.12 | 0.48 | 0.29 | 60 | 15.5 | 17.5 | 15.0 | 85 | 22.5 | 27.0 | 32.0 | 100 |
| 16. | 0.03 | 0.8 | 1.2 | 100 | 1.85 | 2.3 | 1.2 | 48 | 4.0 | 6.0 | 1.2 | 21 |
| 17. | 0.006 | 0.1 | 0.03 | 30 | 1.0 | 2.8 | 0.8 | 32 | 43.0 | 41.0 | 28.0 | 67 |
| 18. | 0.15 | 0.7 | 0.33 | 49 | 4.9 | 3.4 | 2.0 | 57 | 32.5 | 27.0 | 5.0 | 18 |
| 19. | 0.2 | 0.3 | 0.24 | 80 | 0.7 | 0.9 | 0.7 | 90 | 4.8 | 6.0 | 5.9 | 99 |
| 20. | 0.07 | 0.06 | 0.06 | 100 | 1.7 | 2.7 | 1.3 | 47 | 13.0 | 10.5 | 10.0 | 98 |
| 21. | 0.47 | 0.6 | 0.4 | 65 | 0.77 | 0.8 | 0.38 | 47 | 3.2 | 4.4 | 1.9 | 42 |

Numbers represent millions of Bacteria per c.c.
BTB signifies Brom-Thymol Blue Agar.

*coli.* and often staphylocci and bacilli, and that *Bact. coli.* is constantly present in the ileum and cæcum together with an increased variety of types within the bacillus group.

TABLE II.

Types of Organisms isolated from 20 sheep.

| Organism. | No. of sheep from which obtained. | | |
|---|---|---|---|
| | Duodenum. | Ileum. | Cæcum. |
| Bact. coli ... ... | 15 | 20 | 20 |
| Str. fæcalis ... ... | 3 | 3 | 2 |
| Mic. luteus ... ... | 3 | 5 | 3 |
| Staph. albus ... ... | 10 | 3 | 8 |
| Corynebacterium ... | 1 | 1 | 1 |
| Proteus vulgaris ... ... | | | 2 |
| Bac. subtilis ... ... | 4 | 8 | 8 |
| Bac. mesentericus ... | 4 | 2 | 4 |
| Bac. megatherium ... | | | 4 |
| Bac. mycoides ... ... | | | 2 |
| Unidentified bacilli ... | 8 | 8 | 8 |

## Bacillus Group.

Sixty cultures of these organisms were studied in detail and were grouped as follows:

| | |
|---|---|
| Bac. subtilis ... ... ... ... | 20 |
| Bac. mesentericus vulgatus ... ... | 10 |
| Bac. megatherium ... ... ... | 4 |
| Bac. mycoides ... ... ... ... | 2 |
| Unidentified ... ... ... ... | 24 |

## Bacterium Coli.

Since *Bact. coli.* comprised the greatest proportion of the bacteria present in the intestine, the strains obtained were subjected to further study in order to ascertain which types were represented. One hundred and five strains of gram-negative lactose-fermenting bacteria were provisionally classified as *Bact. coli.* All produced indole and ammonia and were Methyl-Red positive and Vosges-Proskauer negative. Their fermentation reactions were examined more fully with the results shown in Table III.

TABLE III.

Types of *Bact. coli* isolated from 20 sheep.

| Type. | Number of sheep from which obtained. | Number of strains. | Sucrose. | Salicin. | Dulcite. |
|---|---|---|---|---|---|
| Communior ... ... | 14 | 48 | AG | — | AG |
| Neopolitanum ... ... | 8 | 12 | AG | AG | — |
| Commune ... ... | 6 | 6 | — | AG | AG |
| Acidi lactici ... ... | 6 | 10 | — | — | — |
| ? ... ... | 2 | 7 | — | — | AG |
| ? ... ... | 4 | 12 | — | AG | — |
| ? ... ... | 1 | 3 | A | AG | AG |
| ? ... ... | 1 | 1 | A | AG | A |
| ? ... ... | 1 | 6 | AG | AG | AG |



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In isolating these strains any slight variation in colony growth was taken into account, and hence the frequency with which any type was isolated is not directly proportional to its actual numbers in the intestine.

The table shows that each of the four recognised types of *Bact. coli.* were encountered, the commonest being the communior variety which was isolated from 14 sheep. The strains which did not fall into any of these types were not further investigated as they were only present in a small proportion of animals.

Six strains were found to be hæmolytic when examined by the tube method [Dudgeon (1921)]. These strains were obtained from 5 sheep but they would probably have shown a higher incidence had there been any method of revealing their presence on the original plates. None were pathogenic to mice.

### Aciduric Organisms.

These bacteria were reported to be present in the fæces of sheep by Mereshkowsky (1905) while Smith (1924) had no difficulty in obtaining them from those of the dog and cat. It was decided to ascertain if they were present throughout the intestine, for which purposes the technique recommended by Davidson (1928) was used and found to be satisfactory. Acid whey broth tubes at pH. 5.6 [Rettger and Cheplin (1921)] were inoculated with 0.5 c.c. of the contents in the case of the duodenum and ileum, and a large platinum spadeful in the case of the cæcum, colon and rectum. After incubating anaerobically at 37°C. for 24 hours one loopful of the culture was inoculated centrally on the surface of a whey agar plate at pH. 6.8 and distributed with a glass spreader. When the plates were incubated aerobically they yielded many colonies of *Strep. faecalis* but few of lactobacilli, but under anaerobic conditions the latter organisms appeared in much greater numbers and were almost invariably isolated from all parts of the intestine in 22 sheep. It did not prove possible to estimate the number of lactobacilli actually present as no satisfactory technique could be devised.

### Cellulose-splitting Bacteria.

The presence of these organisms in the intestines or fæces of animals was first noted by Von Tappeiner (1882) [quoted by Omeliansky (1902)] and has since been confirmed by many observers, e.g., Oemliansky (1902), Khouvine (1928) and Cowles and Rettger (1931). It is generally accepted that they play a considerable part in the digestion of food by ruminants, but it is not known whether they act in this capacity in the rumen only or whether they are capable also of breaking down cellulose in the intestines, in which case it is to be expected that they would be found in considerable numbers in the latter situation. In order to study their distribution it was decided to attempt cultivation in a filter paper medium as described by Woodman and Stewart (1928).

Preliminary tests had shown that, by the use of this medium, cultures of cellulose digesting bacteria could be obtained quite consistantly from samples of rumen contents and from hay. Amounts of 50 c.c. of the medium were

distributed in 100 c.c. bottles and inoculated with 1 c.c. of duodenal or ileal contents or a large platinum spadeful from the cæcum, colon or rectum. Duplicate sets of bottles were incubated, one at 65°C., and the other at 37°C. The higher of these temperatures was included since, when testing the technique, it was found on several occasions to give better growth than incubation at 37°C. The cultures were examined after 7 days incubation and those failing to show good growths were returned to the incubator for a further 7 days.

Material from 24 sheep was examined. Incubation at 37°C. was more successful than at 65°C., thus showing that the thermophilic cellulose-splitting bacteria are not so common in the intestines as those which grow readily at 37°C., while the percentage of positive cultures at 65°C. rises steadily to a maximum in the rectum, the percentage of positive results at 37°C. being greatest in the cæcum. This is shown in Table IV.

TABLE IV.

DISTRIBUTION OF THERMOPHILIC AND NON-THERMOPHILIC CELLULOSE-SPLITTING BACTERIA.

| Situation. | Number of sheep examined. | Cultures obtained at 37.5°C. | | Cultures obtained at 65°C. | |
|---|---|---|---|---|---|
| | | Number. | Percentage. | Number. | Percentage. |
| Duodenum ... ... | 24 | 7 | 29 | 5 | 21 |
| Ileum ... ... ... | 24 | 14 | 58 | 10 | 42 |
| Cæcum ... ... ... | 24 | 22 | 93 | 13 | 54 |
| Colon ... ... ... | 24 | 21 | 87.5 | 17 | 70 |
| Rectum ... ... ... | 24 | 20 | 71 | 18 | 75 |

By plating out the original cultures on nutrient agar, glucose agar and cellulose agar (similar in composition to the liquid cellulose medium referred to above, with the substitution of finely ground filter paper for the torn paper and with the addition of 2 per cent agar), attempts were made to isolate organisms capable of fermenting cellulose. Three types were obtained:

(*a*) A gram-positive sporing bacillus.
(*b*). A gram-negative cocco-bacillus.
(*c*). A gram-positive cocco-bacillus.

None of the organisms, however, could be maintained through more than one or two generations in cellulose media, and it was not possible, therefore, to determine their individual powers of acting on this substance.

## ANAEROBIC FLORA.

### Quantitative Examination.

A quantitative estimation was again attempted volumetrically. For spore counts a dilution of 1/10 was heated to 72°C. for 30 minutes and rapidly cooled, further dilutions being then made. Two types of media were used:

(*a*). Casein digest beef infusion agar.
(*b*). Sulphite agar [Wilson and Blair (1923)].

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Other media tried for the counting of spores were blood agar plates for surface colonies and serum agar plates for deep colonies. These were incubated in McIntosh and Fildes jars for four days at 37°C. and examined daily, but their use was soon discontinued as the growth of spreading colonies of aerobes made accurate counting impossible.

**Casein Digest Medium.**

This medium was used for the estimation of spores only and consisted of a 2 per cent. casein digest beef infusion agar as used by Kahn (1922) for the cultivation of anaerobes from single cells. Growths, however, proved scanty and finally the medium was modified by the addition of horse serum (1 per cent.), cysteine (0.1 per cent.) and gentian violet (1—400,000). The value of cysteine in the cultivation of anaerobic bacteria has already been noted by Hosoya (1925), Quastel and Stephenson (1926), Frei and Riedmuller (1930), Frei and Hall (1931) and Riedmuller (1933). The gentian violet was found to reduce the number of colonies of aerobes which, however, was small in any case since the medium itself appeared to have an inhibitory effect on their growth.

A measured amount of the diluted material was added by means of a pasteur pipette to the depths of the medium at 45°C.; the tube was gently rolled between the hands and cooled in water. To it sterile vaseline was then added to a depth of three cms. Incubation at 37°C. was carried out for four days, colony counts being made every 24 hours. In tubes inoculated from the lower dilutions, difficulty was occasionally experienced as the result of liquefaction of the medium, formation of gas bubbles, or the presence of a film of growth between the medium and the wall of the tube. When the counts were completed representatives of each type of colony were subcultured in meat broth and their characters examined in order that any aerobes found might be deducted from the total. All operations were carried out in duplicate.

The results obtained from 14 sheep are shown in Table V. Very few spores were found in the duodenum and ileum for although a small count was recorded in some instances, the majority of the tubes were sterile. The numbers in the large intestine were greater, but varied considerably in different animals. In no case, however, were very high figures recorded, and perhaps the most noticeable feature was that in most individuals the spores were fairly evenly distributed from the cæcum to the rectum.

**Sulphite Medium.**

Since almost the whole of the anaerobic flora of the sheep's intestine appeared to be of the saccharolytic type, this medium as modified by Davidson (1928) was used for the estimation of both spores and vegetative forms.

The intestinal contents of 10 sheep were examined both with and without preliminary heating. Two drops of the various dilutions were transferred to

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TABLE V.

ESTIMATION OF ANAEROBES PRESENT AS SPORES. (CASEIN DIGEST AGAR.)

| Sheep No. | Duodenum | | Ileum. | | | Cæcum. | | | | Colon. | | | | Rectum. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dilution | Spores per c.c. | Dilution | | Spores per c.c. | Dilution | | | Spores per c.c. | Dilution | | | Spores per c.c. | Dilution | | | Spores per c.c. |
| | 1/10 | | 1/10² | 1/10 | | 1/10³ | 1/10² | 1/10 | | 1/10³ | 1/10² | 1/10 | | 1/10³ | 1/10² | 1/10 | |
| 1. ... ... | — | | — | — | | 80 | 300 | 00 | 412 | | | | | | | | |
| 2. ... ... | — | | — | — | | 10 | 104 | 00 | 75 | 19 | 200 | 00 | 145 | 200 | 00 | 00 | 1500 |
| 3. ... ... | — | | — | — | | 4 | 16 | 00 | 21 | 4 | 00 | 00 | 30 | 4 | 00 | 00 | 30 |
| 4. ... ... | — | | — | — | | — | 4 | 28 | 3 | — | — | 48 | 4 | 8 | 12 | 20 | 23 |
| 5. ... ... | 13 | 1 | — | 13 | 1 | — | — | 20 | 2 | — | 12 | 172 | 11 | — | 28 | 00 | 21 |
| 6. ... ... | 4 | — | 4 | 13 | 2 | 20 | 32 | 00 | 87 | 4 | 60 | 00 | 37 | 16 | 52 | 00 | 80 |
| 7. ... ... | — | | — | — | | — | — | 34 | 3 | — | 6 | 32 | 3 | — | — | 10 | 1 |
| 8. ... ... | — | | — | — | | — | 20 | 162 | 14 | — | 12 | 64 | 7 | 2 | 14 | 82 | 11 |
| 9. ... ... | 1 | — | — | 1 | | — | — | 20 | 2 | — | 10 | 42 | 5 | — | — | 30 | 2 |
| 10. ... ... | — | | — | — | | — | — | 30 | 2 | — | — | 14 | 1 | — | — | 16 | 1 |
| 11. ... ... | 6 | — | — | 4 | — | 36 | 300 | 00 | 247 | 26 | 00 | 00 | 195 | 50 | 00 | 00 | 375 |
| 12. ... ... | — | | — | — | | 24 | 00 | 00 | 180 | 80 | 00 | 00 | 600 | 20 | 00 | 00 | 150 |
| 13. ... ... | — | | — | — | | — | — | 4 | — | — | 4 | 50 | 3 | — | — | 00 | — |
| 14. ... ... | — | | — | 4 | — | — | — | 00 | — | — | 16 | 20 | 7 | — | — | 4 | — |

The figures under each dilution indicate the number of colonies obtained from four drops (30 drops per c.c.).
The number of spores is given in thousands.
00 indicates that a count could not be made.

## TABLE VI.

ESTIMATION OF ANAEROBES (TOTAL NUMBER AND SPORES) BY SULPHITE AGAR MEDIUM.

| Sheep No. | | Duodenum Dilution 1/10² | 1/10 | Spores per c.c. | Ileum. Dilution 1/10³ | 1/10² | 1/10 | Spores per c.c. | Cæcum. Dilution 1/10³ | 1/10² | 1/10 | Spores per c.c. | Colon. Dilution 1/10³ | 1/10² | 1/10 | Spores per c.c. | Rectum. Dilution 1/10³ | 1/10² | 1/10 | Spores per c.c. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Total | 4 | 14 | 5 | — | 27 | 00 | 54 | 5 | 25 | 00 | 75 | 2 | 58 | 00 | 78 | | | | |
| 2. | Total | 3 | 5 | 4 | — | 3 | 27 | 6 | 8 | 5 | 00 | 85 | — | 10 | 00 | 20 | | | | |
| | Spores | — | — | | — | 2 | 7 | 3 | — | 8 | 17 | 10 | 3 | 7 | 23 | 26 | | | | |
| 3. | Total | — | 1 | | — | 4 | 00 | 8 | 9 | 57 | 00 | 147 | 9 | 78 | 00 | 168 | 8 | 20 | 00 | 100 |
| | Spores | — | — | | — | — | 9 | 2 | 2 | 33 | 149 | 44 | 6 | 41 | 200 | 81 | 6 | 18 | 67 | 56 |
| 4. | Total | 2 | 11 | 3 | — | 6 | 14 | 7 | 8 | 48 | 00 | 128 | 1 | 7 | 00 | 17 | 1 | 9 | 9 | 2 |
| | Spores | — | — | | — | — | — | | 2 | 5 | 63 | 21 | — | 6 | 53 | 11 | 2 | 6 | 30 | 19 |
| 5. | Total | — | — | | — | 2 | 11 | 3 | 272 | 00 | 00 | 5440 | 320 | 00 | 00 | 6400 | 8 | 00 | 00 | 1600 |
| | Spores | — | — | | — | — | — | | 134 | 00 | 00 | 2680 | 285 | 00 | 00 | 5700 | 130 | 340 | 00 | 1600 |
| 6. | Total | — | — | | — | — | 9 | 2 | 48 | 00 | 00 | 960 | 68 | 00 | 00 | 1360 | — | 59 | 00 | 118 |
| | Spores | — | — | | — | — | — | | — | 35 | 111 | 46 | — | 9 | 23 | 11 | — | 8 | 20 | 10 |
| 7. | Total | — | 3 | 1 | 7 | 88 | 00 | 155 | — | 37 | 00 | 74 | 4 | 11 | 86 | 39 | — | 7 | 96 | 16 |
| | Spores | 1 | — | | 6 | 00 | 00 | 120 | 2 | 10 | 200 | 33 | 4 | 39 | 90 | 59 | 1 | 27 | 135 | 33 |
| 8. | Total | — | — | | — | — | 20 | 4 | — | — | 10 | 2 | — | 2 | 10 | 3 | — | 3 | 9 | 4 |
| | Spores | — | — | | — | — | — | | — | 4 | 7 | 5 | — | — | 6 | 1 | — | 2 | 12 | 3 |
| 9. | Total | — | — | | — | — | — | | — | — | 87 | 17 | 2 | 4 | 69 | 21 | — | 27 | 100 | 37 |
| | Spores | — | — | | — | — | — | | — | — | 7 | 1 | — | 3 | 3 | 3 | — | 6 | 40 | 10 |
| 10. | Total | — | — | | — | 11 | 44 | 15 | 3 | 50 | 00 | 80 | 1 | 13 | 100 | 22 | — | — | 12 | 2 |
| | Spores | — | — | | 1 | — | 12 | 11 | — | — | 3 | 1 | 1 | — | 24 | 12 | — | 5 | 8 | 6 |

The figures under each dilution indicate the number of colonies obtained from two drops (20 drops per c.c.).
The number of bacteria per c.c. is given in thousands.
00 indicates that a count could not be made.

sterile petri dishes by means of a graduated pipette. To each plate was added 15 c.c. of melted sulphite agar and the inoculum distributed by tilting. When the medium had set, an equal quantity of glucose agar was poured over so as to form a thick layer and thus maintain anaerobiosis. The plates were incubated at 37°C. and examined daily for four days for the presence of black colonies of anaerobes. The results which are given in Table VI show, in the first place, that the spore counts were of the same order as those obtained by the use of casein digest medium and may be regarded, therefore, as being reasonably accurate. On the other hand, the figures representing the total number of anaerobes, in both vegetative and spore stages, could not be checked in any way. It is probable, however, that they would have been higher if the growth of aerobes could have been completely surpressed. The influence of the latter may possibly explain those cases in which more colonies were obtained from heated than from the unheated emulsions, but, alternatively, the experimental error in dealing with relatively small numbers may, in itself, have been sufficient to account for this.

It may be concluded from the counts as a whole that very few anaerobes are present in the duodenum and ileum of normal sheep, though they may amount to a few thousand per cubic centimetre of contents in the latter situation. They are more numerous in the large intestine but, even so, their numbers are usually well below 1,000,000 per cubic centimetre.

### Qualitative Examination.

**Methods of Identification.**

Investigators who have worked on this subject are in substantial agreement as to the criteria by which the common pathogenic types may be identified, but it was found that opinions varied as to the reactions of the less well known non-pathogenic varieties such as *Cl. putrificum*, *Cl. bifermentans* and *Cl. multifermentans*. Additional information concerning the latter was obtained from the reports of Tissier and Martelly (1902), Stoddard (1919), Reddish and Rettger (1922, 1923, 1924), Weinberg, Azner and Duthie (1924), Sturges and Drake (1928), Drake and Sturges (1929) and Cunningham (1932) and, in practice, such organisms were assigned to their respective types according to what appeared to be the prevailing concensus of opinion. A key to the identification of the various non-pathogenic types is given in Table VII. Each strain was examined as to the following characters:

(1). Morphology in Gram-stained preparation.
(2). Type of colony on Zeissler's glucose blood agar plates.
(3). Proteolytic activity.
(4). Action on: Dextrose, Maltose, Mannite, Lactose, Sucrose, Salicin, Lævulose, Galactose, Litmus milk.
(5). Pathogenicity.

The pathogenic anaerobes, other than *Cl. welchii*, were not classified finally until it had been shown that guinea pigs were completely protected against their action by the corresponding antitoxic sera.

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## TABLE VII.

REACTIONS USED FOR IDENTIFICATION OF NON-PATHOGENIC ANAEROBES.

| Organism. | Morphology. | Type on Zeisslers plates. | Meat Broth. | Serum. | Gelatin. | Litmus Milk. | Glucose. | Maltose. | Mannite. | Lactose. | Sucrose. | Salicin. | Dextrin. | Laevulose. | Galactose. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cl. sporogenes. | Rod of medium length (6 u.) and of breadth (1 u.) spores oval and sub-terminal. | II. | Blackened and digested. | Digested. | Liquefied. | Digested. | + | + | − | − | − | − | − | +<br>− | − |
| Cl. putrificum. | Fine slender rod length (7 u.), breadth (.6 u.). Terminal spores. | V. | Digestion occurs after about 10—14 days. | Digested slowly. | Liquefied. | Digested slowly. | −<br>+ | −<br>+ | −<br>+ | −<br>+ | − | − | − | − | − |
| Cl. bifermentans. | As Cl. sporogenes. | II. | Slight blackening after some days. | Slight or no digestion. | Liquefied. | Digested. | + | + | − | − | − | − | − | + | − |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cl. tertium. | Fairly long rod (7 u.), breadth (.5 u.–.7 u.). Spores oval and terminal or nearly so. | V. | No blackening. | No digestion. | No liquefaction. | Acid clot, some gas. | + | + | + | + | + | $\frac{+}{-}$ | + | + | + |
| Cl. sphenoides. | A fairly thin rod (.7 u.) of medium length (6 u.) spores terminal and round. | IX. | No blackening. | No digestion. | No liquefaction. | Acid clot. | + | + | − | + | + | − | + | + | + |
| Cl. multifermentans. | Rather long (8–9 u.) rod of medium breadth (1 u.) spores subterminal. | II. | No blackening. | No digestion. | No liquefaction. | Acid clot. | + | + | − | + | + | + | + | + | + |
| Cl. tetanomorphum. | Long thin rod (8 u. × .6 u.) spherical terminal spores. | VII. | No blackening. | No digestion. | No liquefaction. | No change. | + | + | − | − | − | − | − | $\frac{+}{-}$ | − |

+ = Acid and gas.
$\frac{+}{-}$ = Slight acid and gas.
$\frac{-}{+}$ = Usually no change—occasional acid and gas.

The morphology in surface colonies and in meat broth tubes was examined after incubation at 37°C. for 24 hours and again at 7 days, while the type of colony on Zeissler's plates was noted at 24 hours and 4 days. The presence or absence of proteolytic properties was determined by the examination of cultures in meat broth, solid serum and gelatin after an incubation period of 21 days.

The medium used for studying the fermentation reactions was 1 per cent., peptone water containing 0.5 per cent. sugar and 0.1 per cent. cysteine, the latter being added from a sterile 10 per cent. solution after the tubes had been steamed and cooled rapidly. These were then inoculated by means of a Pasteur pipette with single drops of culture and sufficient sterile vaseline to form a layer three centimetres thick was added to each tube. The seal served not only to maintain anaerobiosis but also to afford an indication of the presence or absence of gas. After 24 hours incubation at 37°C. the tubes were examined and those in which the vaseline seal had been forced more than 2 centimetres up the tube were removed, the seal punctured with a pipette and two drops of litmus solution run in. This invariably gave a red colour indicating the presence of acid. The tubes which did not show this amount of gas were returned to the incubator for a further 7 days when they were removed and treated similarly. The table shows *Cl. putrificum* as fermenting no sugars. Weinberg and Ginsbourg (1924) however, showed that races of this organism occasionally fermented one or other of the substrates and, therefore, types which were otherwise *Cl. putrificum* but fermented a sugar have been considered to be this organism.

The organisms were tested for pathogenicity by the intramuscular and intraperitoneal injection of mice with 0.5 c.c. doses of a 24 hour culture in Bouillon "V.F." This medium consists of a peptic digest of ox liver and ox muscle and was used because it yielded cultures of greater virulence than those in other media.

(*To be continued*)

# Clinical Articles

## A NATURAL MEND OF A FRACTURED TIBIA IN A YOUNG KUDU BULL

By HARVEY S. PURCHASE, B.Sc., F.R.C.V.S.
*Machili Experimental Station, Northern Rhodesia.*

THE local villagers rescued the body of a young Kudu bull from wild dogs (Lycaon Pictus). On close examination of the carcass it was noted that the right hind leg had a large excrescence covered with horny growth. This outgrowth was roughly cylindrical, measuring two inches across the diameter and the same in height. On dissection it was revealed that the horny growth covered the lower end of the tibia which had been fractured about an inch above its distal articular surface. The shaft of the tibia had been forced downwards along the medial surface of the tarsal bones and ossific union had taken place between the two portions of the tibia which were side by side and also between the tibia and tarsal bones. All the tarsal joints had thus been immobilised.

The accompanying photographs illustrate the growth and also the weedy crossed hoofs which apparently had not been in normal use for some time. The absence of any muscular atrophy in the hindquarters, which were perfectly normal and equal, was remarkable.

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## THE TREATMENT OF DEMODECTIC MANGE OF CATTLE WITH NEOSALVARSAN

By HARVEY S. PURCHASE, B.Sc., F.R.C.V.S.
*District Veterinary Officer, Machili Experimental Station, Northern Rhodesia.*

IN the literature which accompanies the Neosalvarsan brand of Neoarsphenamine prepared by Bayer is to be found a list of various animal diseases "specifically affected" by this drug.

I had heard it expressed by the Deputy Director of Veterinary Services (Mr. R. A. S. Macdonald, B.Sc., M.R.C.V.S.) as his opinion that local dressings were useless in combating bovine follicular mange and that probably the most hopeful way of overcoming this disease lay in the direction of intravenous and subcutanous medication.

Two cases of follicular mange have occurred in the station cattle kept for Pleuro Pneumonia experimentation. Both cases spread extensively over the body although in all other respects the course of the disease differed widely in the two animals. Each case is hereunder described separately.

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**Cow No. 157.**

This was an old Mushukulumbwe cow in fair condition. The onset of the disease was very sudden. The animal ceased to graze one morning and scratched herself on every possible occasion against any available object. In the evening the whole body was oozing yellow serum, not only where she had scratched herself, but also from all the hair follicles all over the body. The temperature was 107.2°F. and the beast looked a picture of dejected misery.

There was extensive oedema of the dewlaps which thickened this region grossly. No definite diagnosis was made as to the possible cause of these sudden acute symptoms until some of the serum and upper layers of skin were examined. Under the lower power of the microscope, unusually active *demodex* were seen. These ran across the field in 35 seconds when viewed through a one-sixth inch objective. The parasites appeared much thinner (i.e. longer in proportion to width) than those usually met with in chronic follicular mange of cattle. Particular comparison was made with the parasites from cow No. 87.

The cow was given 1.2 gm. of Neosalvarsan intramuscularly. Next morning the itch had ceased, the temperature had dropped to normal and the cow grazed normally. The serum-ooze stopped and thirty-six hours later no live parasites could be seen in scraping from the badly affected areas. This cow made a complete and uneventful recovery.

Such an acute and fulminating case had not been noted before. It is assumed that the sudden onset of the symptoms was due to the sudden increase of a few dormant parasites together with the drop in the cow's resistance against this infection. This state of affairs was brought about by the sudden hot weather following the cold season and the veld grazing drying off rapidly.

**Cow No. 87.**

The course of the disease in this old Barotse cow was typical of hundreds of these cases met with all over Northern Rhodesia. A few infected follicles were noted around the muzzle and head. As the grazing dried off and the weather became hot the follicular infection spread along the neck, chest, and finally to the hindquarters. There was continuous itch and the cow scratched itself incessantly with the resulting loss of condition. Very few follicles were " ripe " for bursting and the parasites were sluggish and thick as compared to those from Cow No. 157. No parasite was seen to crawl across the field under a low power objective lens of the microscope.

The cow was given 0.9 gm. of Neosalvarsan subcutaneously. There followed this injection a remarkable cessation of scratching. Many of the follicular abscesses burst and healed. Microscopic examination ten days later showed hordes of dead and disintegrating parasites. Continuous search revealed a few live parasites. A second dose, this time 1.2 gm. intravenously, was administered. The improvement continued and eleven days later examination of the follicular pus showed dead parasites. Blood stained scrapings from the walls of unburst

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Note.—Horny growth and also Crossed Hoofs.

A. Shaft of Tibia forced alongside Tarsal Bones.

B. Broken Distal End of Tibia

(Article by Harvey S. Purchase, B.Sc., F.R.C.V.S.—page 75.)

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abscesses revealed a few immature live parasites. A third dose of Neosalvarsan was given intravenously (1.2 gm.). Three weeks after this a fourth examination still revealed a very few live sluggish parasites in the blood-stained scrapings. The condition of the cow had improved immensely. A fourth injection of Neosalvarsan was given intravenously (1.2 gm.) but three weeks later a few live parasites were found after prolonged search.

**Comments.**

The acute disease described is not common. The cure following subcutaneous injection of this drug was remarkable.

In the second case which is the kind commonly found in this country, the animal improved immensely after medication with Neoarsphenamine, but even after four doses a few live parasites were found.

# Abstracts

In welcoming and wishing success to our new contemporary, *The Canadian Journal of Comparative Medicine*, opportunity has been taken to extract from it an article written by Dr. Panisset on the re-organisation of the Veterinary Services of Quebec, the French Province of Canada, and is of interest at present when a re-organisation of the activities of the Veterinary Department of the Ministry of Agriculture of Great Britain is being effected.

Some important innovations have taken place in the Province of Quebec concerning the organisation of the veterinary activities of the provincial Ministry of Agriculture.

**Creation of an Autonomous Provincial Veterinary Service.**

There has existed, for a number of years, in the Ministry of Agriculture, a section of veterinary medicine forming part of the Animal Industry Service. This section had the disadvantage of being subordinate to non-veterinary chiefs. The Minister of Agriculture has now acceded to the wishes of the veterinary profession by putting an end to this anomaly and henceforth the Health of Animals Service will control the provincial veterinary organisation.

The Service has been placed under the direction of Dr. G. M. Veilleux who has, for some years, been responsible for the direction of studies at the Veterinary School and will continue to do so. It is important that the direction of the Services has been conferred on a veterinarian who has gained his experience in the rough school of long years of professional practice, which will be of great value when he is to carry out the technical work and orders of an administrative service; coupled with this, the personal qualities of the new director is a happy augury for the future of Agriculture and our profession.

**Creation of a Consultative Committee.**

There exists, in various countries, certain organisations which have for their rôle the advising of persons responsible for the direction of veterinary services.

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These organisations are usually composed of veterinarians independent of the administration, and form a permanent liaison betwwen the latter and the general practitioner. The Consultative Veterinary Committee which has been formed in the Province of Quebec consists of veterinary practitioners, the Veterinary School and the School of Agriculture.

**Rôle of the Service and Plan of Work.**

The organisation of the provincial Veterinary Service is not on all lines exactly the same as that which exists in other countries. The Federal Government will still deal with contagious diseases and meat inspection; nevertheless, in spite of these limitations the provincial Veterinary Services can play a very important part in the hygienic care of farm animals, such as dealing with certain contagious diseases not included in the Federal Regulations, e.g., epizootic abortion, contagious mamitis, infectious anæmia of horses and their eradication. It will, no doubt, as soon as possible, in the general interest, inform the agricultural population of the benefits to be derived from the utilisation of the services of general practitioners.

Here a short digression may be made to show that in certain countries the State intervenes more and more in veterinary activities such as police sanitary service, professional practice and essential information. The veterinary law of the Reich, recently promulgated, constitutes the most typical example of this kind of organisation. In other countries the intervention of the State becomes more and more important although the fact is more or less disguised.

Some other countries remain faithful to the old individual methods. In France the rôle of the veterinary services continues to be limited to the issuing of veterinary information and the application of the laws concerning contagious diseases, but it is the veterinary practitioner alone who enters into direct contact with the stock-owners in dealing with contagious or non-contagious diseases. Research laboratories send out official information and advice to veterinarians. For special reasons and the customs of the country the first method (complete State control) would be inacceptable, and the second, by reason of the extent of the country and the small number of veterinarians, would be inapplicable for; let us remember that in France nearly 3,000 veterinarians earn a living.

Let us examine some of the aspects of the rôle of the new Veterinary Service in its struggle against the most important diseases.

In the equine species it will no doubt take up the subjects of intestinal parasitism, the prophylaxy against infectious anæmia and the diseases associated with reproduction. Helminthiasis is so widespread as to seriously affect horse breeding in the Province. So long as the affection does not produce any alarming signs and the condition does not appear to require anti-parasitic treatment then, without official intervention, a small proportion of animals only may be treated. For several years the Minister of Agriculture has organised a collective treatment of horses. Unfortunately the parasiticide used was carbon-bisulphide, and produced

some regrettable accidents. For this reason many practitioners refused to continue this treatment and it has been necessary to substitute carbon-bisulphide by an efficacious and inoffensive parasiticide.

As a result of experiments carried out at the Veterinary School at Oka a new method has been adopted by Dr. Labelle, Professor of Veterinary Medicine, and this method has now been generally adopted by the Veterinary Service.

As formerly, the cost of the treatment must be borne by the owners of the animals. The Ministry arranges for propaganda, organisation, collection of the horses and furnishing the anthelmintic.

Different regions of the Province of Quebec are affected by infectious anæmia of horses which has caused considerable loss and serious anxiety amongst the agricultural population. This disease has often been confounded with anæmia of parasitic origin. Studies pursued for two years at the Veterinary School have shown that the conditions observed are generally due to a true infectious anæmia and not to a parasitic anæmia. The diagnosis of infectious anæmia presents certain difficulties. The treatment is costly; this hinders eradication of the disease if left entirely to private initiative. It has, therefore, been decided to assist veterinary practitioners by giving them technical advice from the research laboratories at La Trappe where a special study has been made of this disease. Veterinarians who have been interested have been shown the value of the sedimentation test which gives interesting results. All these veterinarians have received, free of cost, the necessary material to carry out tests. The Ministry has agreed to bear the greater part of the expenses of treatment on the condition that practitioners will keep the Veterinary Services informed of all the work carried out and collaborate in any enquiry as to the spread of the disease in the Province.

In the interest of the work to be carried out it is understood that the Ministry will furnish, free of cost, the medicine, that the proprietors pay the first visit of the practitioner and the expenses be defrayed as follows:

25 per cent by the Proprietors.
75 per cent by the Ministry.

It will thus be possible not only to extend the benefits of treatment but also to collect, thanks to the clinical reports to be forwarded by practitioners, exact and extensive information on the character and frequency of the disease in the Province and the efficacy of the work done. The drugs to be used are stovarsol, acetarsone, prevarsyl or permanganate of potassium which, administered by intravenous injections in suitable doses, gives interesting results.

Diseases associated with reproduction, epizootic abortion and sterility will form subjects for special consideration. Mares will undergo annual seriological tests and young mares which have not proved in foal after mating will be examined at the cost of the Ministry.

Concerning bovine mammitis, examination will be made of herds, in particular those which furnish milk to the town of Montreal, by suitable methods, clinical examination, bromothymol, etc.

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Classification of the dairy cows and elimination of animals found unsuitable for milk production.

These measures will gradually be extended to other regions of the Province. It has been decided to return to the prevention method of vaccine-therapy which previously gave rise to controversy.

The work will be undertaken in different parts by veterinarians operating the same methods but independent of each other. Prophylaxy against epizootic abortion will be modified. Sero-agglutination tests will not be carried out free of cost by official laboratories except for proprietors of Stud Book animals and those intended to be introduced into herds which are under Service supervision. They will also be carried out at the request of the provincial and municipal services. To profit by the " free of cost " services the proprietors must, in all cases, undertake in writing to carry out the rules concerning the identification of the animals and the advice given by the service. It has been shown in the past that for herds in the regions free from tuberculosis purchases have been made without taking precaution that animals introduced are free from epizootic abortion. It has, therefore, been decided that the Ministry will organise gratuitous examination of all bovines destined for entry into these tuberculosis-free regions.

The biological products used in the prophylaxy against blackleg and hæmorrhagic septicæmia of bovines will, as in former years, be supplied free of cost to veterinarians.

Diseases of pigs, sheep and poultry do not always receive the attention necessary by proprietors; it is, therefore, important that they should be informed as to the benefits to be derived from consulting veterinarians. The Veterinary Service intends to improve the sanitary condition of these species by instituting enquiries as to the collective diseases, contagious, parasitic and dietetic and thus, by means of pamphlets, conferences and circulars, show the methods to be followed to prevent these diseases.

On the subject of pullorum it has been decided to adopt the most rapid method of diagnosis as a basis of prophylaxy while the slow method will continue to be used as a means of verification. Thanks to economy in operating it will be possible to give veterinary attention to a large number of herds.

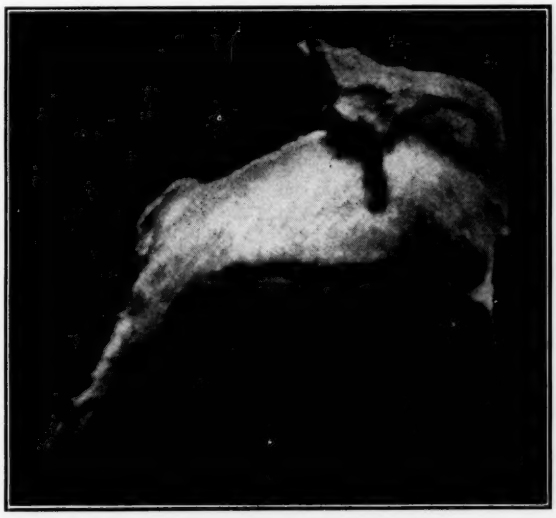
Lastly, refresher courses will be given, during some months, at the Veterinary School. These courses will be for practitioners who aim at adopting the newer methods and at the same time make useful contact with other practitioners and specialists. It will, therefore, be seen by the foregoing that the new service has in front of it an interesting and useful programme and although its existence only extends over four months the task which has already been accomplished shows that the " Service of Animals Health " will be of great value to veterinarians and agriculturalists who place their hopes in it.

(Free translation from *The Canadian Journal of Comparative Medicine.*)

Hindquarters shewing results of scratching, and beads of Serum.

Thickened Dewlap (Oedema). Note beads of serum.

(Article by Harvey S. Purchase, B.Sc., F.R.C.V.S.—page 75.)



Tetanus in a Goat. The animal lies with its breast and belly free on a table.
(Article by Dr. H. Gottlieb—page 82.)

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## ABSTRACT FROM THE JOURNAL OF THE SOUTH EASTERN AGRICULTURAL COLLEGE, KENT

DR. A. D. MCEWEN, D.Sc., M.R.C.V.S., Chief of the Veterinary Department, referring to Contagious Abortion of Cattle, reports that the field tests on the immunization of cattle with a vaccine prepared from a non-virulent strain of *Br. abortus* have been continued. Vaccination trials in eight infected herds under test for a period of two years or more, show, that of 232 vaccinated cows, 6 per cent. became infected with *Br. abortus* and that 5 per cent. of their pregnancies terminated in abortion during the first year after vaccination. At the end of the first year only 184 of the 232 cows present at the beginning of the year remained. At the beginning of the second year none of these 184 cows showed evidence of infection, and during the year only 1.6 per cent. became infected and 0.7 per cent of pregnancies among the vaccinated animals terminated in abortion. Fifty-eight of the vaccinated animals have been followed into a third year and none has become infected with *Br. abortus*. In only two of these herds was it possible to keep control animals, and the results on these two herds are summarized.

| Year | No. vaccinated. | No. became infected | % infected | No. of controls | No. became infected | % infected |
|---|---|---|---|---|---|---|
| *Herd 2* | | | | | | |
| 1st | 28 | 0 | 0 | 20 | 2 | 10 |
| 2nd | 23 | 0 | 0 | 11 | 2 | 18 |
| 3rd | 9 | 0 | 0 | 5 | 1 | 20 |
| *Herd 3* | | | | | | |
| 1st | 81 | 4 | 5 | 78 | 3 | 4 |
| 2nd | 67 | 2 | 3 | 62 | 12 | 19 |
| 3rd | 29 | 0 | 0 | 24 | 6 | 25 |

Vaccination has been discontinued in a number of herds for a variety of reasons, including the sale of herds, the Ministry of Health's order prohibiting the use of live vaccine on tuberculin tested herds, and inefficient co-operation at the farm. The returns from fourteen herds upon which vaccination was started more than two years ago and which contained 847 cows when first tested show that for one reason or another only 184 vaccinated cows could be followed into a second year. These figures are in some respects disappointing, especially if it be admitted that vaccination trials in infected herds become more critical during the second year, the reason being, that some animals, negative to the agglutination test may nevertheless be infected when first vaccinated, and for some time after vaccination has been practised it is not known whether animals which show infection do so because of infection acquired before or after vaccination.

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## TETANUS IN A GOAT

**By Dr. H. GOTTLIEB.**

*Mistelbach, S. Austria. Wiener T. Monatschrift, January 1st, 1938*

A RARE case of tetanus in a 4 months' old goat appears to be worth recording. According to the owner he first noticed that there was difficulty in swallowing, it was suspected that there might be a foreign body in the gullet. On the next day stiffness was noticed in the fore and hind limbs, and within 24 hours the limbs became so fixed that the animal could no longer stand up. At the same time a certain stiffness in the carriage of the neck occurred, which developed on the 4th day to complete curvature of the neck on the back. On this day I had the opportunity of seeing the animal. It lay stiffened out on the floor of the stall. The muscular tissue felt as hard as a board and gave one the impression that the body was frozen. Attemps to rise or turn were prevented by stiffening. Fore and hind limbs were in maximal extension and the head lying on the back (see figure).

No external wound could be found. The port of entry of the bacillus appeared to be due to a rose thorn penetrating the mouth or gullet, as the goat had been browsing on some rose bushes in the garden.

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## THE SO-CALLED SKIN TUBERCULOSIS IN CATTLE

**By G. T. KRANTZ.**

*Skandrsk V.-Tdscrft*, January, 1938.

THE author gives a general account of skin-tuberculosis in cattle, above all of *the skin lesions in tuberculin reacting cattle* which has been observed in the U.S.A. especially. In this connection the author describes 40 cases of similar alterations in cattle from Gotland. Such alterations have not been observed before in Sweden.

The alterations which, as a rule, are localized to the subcutaneous tissue on the distal parts of the legs and the ventral side of the chest and abdomen display the picture of a typical tuberculous granulation tissue. In 2 cases there has been observed a penetration by the alterations into the cutis. Regional lymph glands, which have also been examined in 32 of the cases, have in 12 cases exhibited tuberculous-like alterations consisting, as a rule, of fresh epitheloidal tubercles with a larger or smaller number of Langhan's giant cells. In 3 cases only have there been demonstrated macroscopically observable tuberculous-like alterations of lymph glands.

Acid-fast rods have been observed in 35 of the subcutaneous nodular-formations, and in 7 of the 12 lymph glands which had displayed tuberculous alterations. As a rule, the rods were somewhat shorter than ordinary bovine

tubercle bacilli; they frequently had lumpy ends and were not always granulated. Fairly numerous free and acid-fast granules have not unfrequently been observed.

Clinically, all the animals have re-acted to the tuberculin test, 39 to the intracutaneous test and 1 to the thermo-test. In 11 of the cases, alterations have been demonstrated clinically by palpation.

Inoculations have been carried out with guinea pigs and rabbits, the material employed being taken from 19 of the cases. All the inoculations have resulted negatively (In 11 of the cases, the experimental animals were allowed to live as long as 6 months after inoculation).

Direct application of culture from 11 of the cases, partly on LOWENSTEIN's substratum and partly on BESREDKA's substratum, has been without result.

Most probably, the path of infection has been via the skin.

In consequence of the difference displayed by these subcutaneous alterations from true tuberculosis, the author has employed the term " so-called skin tuberculosis in cattle " as the name of these subcutaneous nodular formations in cattle.

Etiologically, this so-called skin tuberculosis still remains unexplained.

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# AN UNKNOWN EIGHTEENTH - CENTURY TREATISE ON VETERINARY SCIENCE

By Dr. FRANK R. LEWIS

*Royal Society of Arts, London, W.C.2*

IN the archives of the Royal Society of Arts I recently discovered a short eighteenth-century treatise, the existence of which hitherto appears to have been unknown. It is not listed in the standard bibliographies such as Halkett and Laing's *Dictionary of Anonymous and Pseudonymous English Literature*, and there is no copy in the British Museum. The treatise is of quarto size and 42 pp. in length, including an introduction. It has the title *A Short Treatise on the Glanders, and Farcy; by a Lieutenant of Dragoons.* Printed for the author at Bridport, Dorset, in 1797, it bears the motto " Ne minima averseris " on the title-page.

The author's introduction is addressed to " The Right Honourable the President and Members of the Society for the Encouragement of Arts, Manufactures and Commerce," and begins with the following words:

> " Being perfectly aware that any Undertaking that is intended for, and exhibits the least Prospect of being useful to Society, is sure to meet with every Attention from you that it deserves, I am induced to submit the following Pages to your Protection and Patronage; and when I consider how little hath been yet done, and the few Efforts that are made to conquer the pestilential progress of the Glanders, I assume a right to anticipate your Candor, without laying any claim to your Approbation; but as the Principles adduced for the support of my Theory, may (perhaps) appear to carry with them a small share of seeming Conviction, I do not despair of exciting in some degree, your Good will and Attention."

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It would be interesting to discover if this is the only copy of the treatise still preserved. But in any event, the copy which I have seen has a particular interest; for two letters stuck to the fly-leaf enable us to establish that the " Lieutenant of Dragoons," was one, Thomas Pate Hankin, of the 2nd Royal Greys Regiment; and record, furthermore, that only 350 copies of the book were printed. The letters are as follows:

1. BRIDPORT BARRACKS, DORSETSHIRE, Janry. 20th, 1797.

Lieutenant Hankin (of the Royal Greys) requests to have the honour of presenting the inclosed Pamphlet to, The Right Honorable, and Honorable the Members of the Society for the encouragement of Arts, Manufactures, and Commerce, and in confidence to intrust them with the name of the Author, the which would have been annexed to the Pamphlet, but from the consideration of his being totally unknown to the Literary-World, and being fully convinced that no advantage would accrue from such an appendage.

2. BRIDPORT BARRACKS, January 23d., 1797.

Sir,

I should esteem it a particular favour if you would do me the honour to correct for me, and Erratum in the Treatise on the Glanders, the which I had the honour to enclose for your Society on Saturday last—Page twentieth—line twelveth—for *vise versa* read *vice versa*. This blunder arose from reposing too much confidence in the Printer and was not discovered until the Mail Coach had set off.

I am just informed that I have to apologize for my want of knowledge in the method of sending the Pamphlet, which I now understand should have been directed to you (this letter is endorsed to J. Moore, the Secretary), instead of the Society at large, but as I once had the Honour of being introduced to you by Mr. Vickery, I will take the earliest opportunity of making my acknowledgments in Person.

I have the Honor to be, Sir,
your very obliged humble Servt.,
THOS. PATE HANKIN. 2d. Royal Greys.

P.S. Having printed (for the present) only 350 Coppies, I do not mean to advertise them; but should any Gentleman be inclined to patronize the Publication the will be found on Saturday next at: Mr. Nicolo, Kings Book Seller—Pall Mall.

A word or two may be devoted to the contents of the book. Hankin maintains that glanders is a local disease and is not incurable. He distinguishes four different forms of glanders and prescribes slightly different treatment for each, but the general plan " is to stimulate the glands of the *insensible transpiration* into an increased and active discharge, by warm clothing and large doses of JAMES'S Powders, so as to produce sweating to an excessive degree." (*P.* 25.)

Glanders can be transmitted to human beings, often with fatal effects, and it seems probable that Hankin had seen cavalry officers stricken with the disease. He had obviously devoted considerable attention to his subject, for his diagnosis and methods of treatment are very good, especially since it is difficult to discover whether a horse is suffering from glanders without the use of a toxin called Mallein, which was discovered in 1888. Glanders is no longer treated because of the danger of infection, and horses found to be suffering from the disease are immediately destroyed.

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# Reports

## Report of the Chief of the Bureau of Animal Industry for 1937—U.S.A.

THE work of the Bureau of Animal Industry dealt during the last year, as formerly, with the prevention, control and eradication of animal diseases and parasites; the administration of various Federal livestock laws; inspection work; and research. The continued freedom of the United States from many of the more serious livestock diseases that prevail in foreign countries is gratifying. Prominent among these are foot-and-mouth disease, rinderpest, contagious pleuropneumonia and surra.

The Bureau has continued to concentrate its efforts on several major activities, notably the suppression of tuberculosis, Bang's disease, and tick fever. Meanwhile it continued its regulatory and research functions as well as undertaking several new projects.

### Tuberculosis Eradication.

This work is in its twentieth year; 13,750,000 tests were made and 0.7 per cent. reacted. There appears to be excellent prospects of reducing tuberculosis to vanishing point.

### Bang's Disease.

Eight million cattle were tested by the agglutination method; 5 per cent. were reactors. Scientific research shows the most promising present method of protection is vaccination during calfhood; 89 per cent. as against 27 per cent. controls.

### Tick Eradication.

This work began in 1906 and the quarantine area has been reduced to one-twentieth of its original size.

### Meat Inspection.

71,223,306 animals and their products were inspected; an increase of 9,000,000, or 15 per cent., of all classes of animals. Tuberculosis as a cause for condemnation was less than 2/3rds compared with 1936.

| | *Ante-mortem inspection.* | | | *Post-mortem inspection.* | |
|---|---|---|---|---|---|
| *Kind.* | *Suspected.* | *Condemned* | *Total* | *Condemned* | *Total* |
| Cattle ... ... ... | 120,852 | 4,005 | 10,904,716 | 71,582 | 10,900,631 |
| Calves ... ... ... | 9,464 | 3,924 | 6,409,533 | 23,205 | 6,413,820 |
| Sheep and lambs ... | 3,605 | 6,304 | 17,663,158 | 45,847 | 17,656,798 |
| Goats ... ... ... | 10 | 22 | 12,685 | 49 | 12,663 |
| Swine ... ... ... | 75,343 | 11,876 | 36,237,355 | 98,073 | 36,226,309 |
| Horses ... ... ... | 19 | 21 | 13,106 | 113 | 13,085 |
| | 209,293 | 26,152 | 71,240,553 | 238,869 | 71,223,306 |

**Meat and Meat Food Products Exported.**

| | |
|---|---|
| Beef and beef products ... ... ... ... | 35,030,584 lbs. |
| Mutton and lamb ,, ... ... ... ... | 2,852,471 ,, |
| Horse meat ,, ... ... ... ... | 1,517,130 ,, |

**Meat and Meat Food Products Imported**

| | |
|---|---|
| Beef and veal, fresh ... ... ... ... | 1,785,434 lbs. |
| Pork ,, ... ... ... ... | 18,199,672 ,, |
| Mutton and lamb ,, ... ... ... ... | 103,984 ,, |
| Beef, canned ... ... ... ... | 77,036,869 ,, |
| Pork ,, ... ... ... ... | 32,380,382 ,, |
| Miscellaneous ,, ... ... ... ... | 1,452,288 ,, |
| Beef, cured ... ... ... ... | 1,684,966 ,, |
| Pork ,, ... ... ... ... | 9,025,389 ,, |
| Sausages ... ... ... ... ... ... | 1,016,579 ,, |
| Oleo ... ... ... ... ... ... | 5,594,543 ,, |
| Tallow-edible ... ... ... ... ... | 16,950,949 ,, |
| Miscellaneous ... ... ... ... ... | 2,708,466 ,, |

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**Regional Laboratories Established.**

Three laboratories have been established.

(1) Swine breeding at Ames, Iowa.
(2) Sheep breeding at Dubois, Idaho,
(3) Animal Health at Auburn, Ala.

**Animal Breeding and Meat Research.**

The work done shows progeny testing as a sound basis for selecting breeding stock. Outward appearance of animals is a less valuable indication of quality. Other factors established included age of animals, time of slaughter, feeds, fattening, methods of handling and storing carcases until used.

**Importation of Live Stock.**

| | |
|---|---|
| Cattle ... ... ... ... ... ... ... ... | 11,418 |
| Sheep ... ... ... ... ... ... ... ... | 2,365 |
| Dogs ... ... ... ... ... ... ... ... | 983 |
| Horses ... ... ... ... ... ... ... ... | 792 |
| Swine, goats and cats ... ... ... ... ... | 146 |
| | 15,704 |

**Veterinary Education.**

From ten veterinary colleges 283 students graduated and 2,307 were enrolled.

**Personnel.**

4,012 persons are regularly employed by the Bureau.

**Meat Investigations.**

Interesting work has been done in this section. Tests to show the percentages of ham, loin, and bacon with Danish Landrace, Poland-China and Duroc-Jersey, showed yield of loin to be significantly in favour of the Landrace.

**Sub-freezing of Fresh and Cured Meats.**

Pork loins kept for seven days at 20 degrees F. then thawed and roasted showed no difference from those kept at 34 degrees for same period. The same results were obtained with storage for 29 days at 20 degrees F., but loins stored for 181 days were dry, tough, strong in flavour and undesirable compared with paired loins stored for 34 days at 20 degrees. Shrinkage in weight ranged from 7 per cent. for 7 days to 14.1 per cent. for 181 days storage.

The report is of so great value that it should be obtained by all who are interested in animal husbandry.

## REPORT OF THE POULTRY TECHNICAL COMMITTEE FOR GREAT BRITAIN

THE report of the Poultry Technical Committee for Great Britain, appointed by the Minister of Agriculture and Fisheries and the Secretary of State for Scotland, is published to-day (February 8th). The Committee, under the Chairmanship of Sir Duncan Watson, has investigated the methods of supply and distribution of hatching-eggs, day-old chicks, and breeding stock, with special reference to the incidence of mortality. The report, published at one shilling (post free, 1s. 2d.), can be obtained from His Majesty's Stationery Office, either directly or through any bookseller.

Drastic recommendations are made. The finding of the Committee is that the poultry industry is to-day struggling under an almost impossible handicap of diseased or weakly stock, and that its state can only be described as one of emergency. Radical measures, it is stated, are necessary, and must be taken at once, if the industry is to be preserved. Statutory control of stock distribution is an urgent requirement, but no unnecessary interference in breeding methods is recommended.

Deaths at egg-laying trials have risen from 6.6 per cent. in 1926-27 to 17.7 per cent. in 1936-37. This rapid rise in mortality among laying birds is reflecting in the poultry flocks of the country generally. The Committee refer to surveys of poultry farms carried out in many areas by agricultural economists, which establish this fact. In Wales, for example, a survey of 49 farms showed that in 1936-37 the original number of hens in the laying flocks had been reduced by 55 per cent. by deaths and removals; in Yorkshire, a reduction of over 60 per cent. was similarly recorded from a survey of 26 farms. The Committee paid numerous visits to farms to secure first-hand information, and mention cases of deplorable losses from mortality, which, it is stated, represent calamities that are occurring with distressing frequency throughout the poultry industry to-day.

The Committee state that this position is associated with the unprecedented demand for stock, hatching-eggs, and day-old chicks in post-war years arising from the too rapid expansion of the poultry population, under the stimulus of high egg prices. Stock of low vitality and stamina, due to unsuitable breeding methods adopted in an effort to meet this demand has permeated the industry. The expansion has also led to overcrowding, with its attendant ill effects; to bad methods of husbandry, particularly on the part of " new comers " with insufficient knowledge and poultry experience; and to specialisation in many directions, especially in the hatching of day-old chicks for supplying to the commercial egg producer. The position has been aggravated by the extent to which the poultry keeper has come to rely on press advertisements as a guide to the purchase of stock of all descriptions; and further by the increased use of auction markets, subject to inadequate control, as a medium for the purchase of day-old chicks, hatching eggs, and even breeding stock.

The rise in the scope and importance of the industry has not been accompanied by an increase in scientific research on a scale at all commensurate with the requirements. Particularly is this the case with research into mortality, the provision for which has been, and is, gravely inadequate. As an indication of this, it is stated that by far the heaviest mortality losses now being experienced by poultry keepers are due to a group of ailments the cause of which is unknown, and for which no curative or control measures can be advised.

Drastic and urgent measures to cope with the present position are recommended. This distribution of diseased or debilited stock of all descriptions must be stopped. Steps must be taken to secure an all-round improvement in the quality of breeding stock. Efforts must be made to build up foundation stock of guaranteed history, particularly from the standpoints of health and stamina, for introducing into the pedigree breeding flocks of the country. The operations of hatcheries, of dealers, and of auction sales must be controlled. Unscrupulous advertising must be checked. Simultaneously, research into the causes of mortality must be prosecuted on a much greater scale, and educational facilities

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must be extended to secure the more general adoption of sound methods of husbandry.

To secure these objectives requires the establishment of an independent organisation, with statutory powers, and so constituted as to ensure that the various sections of the industry affected are not only consulted in the formulation of schemes, but are closely concerned in the administrative functions involved in carrying the schemes into effect.

The Committee recommend, therefore, the establishment of a Poultry (Stock Improvement) Commission for Great Britain, to be appointed by the Secretary of State for Scotland and the Minister of Agriculture and Fisheries, with Advisory Councils for England and Wales, and for Scotland, appointed by the respective Ministers, and with a Standing Executive, also appointed by the two Ministers, consisting of the Vice-Chairman of the Commission, the Chairmen of the two Advisory Councils, and two other members, to which would be referred the numerous difficult problems arising in the course of administering the policy of the Commission.

The Commission would be charged *inter alia* with the following duties and obligations:

(*a*) The compulsory registration of every distributor of stock, hatching eggs and day-old chicks, subject to such exemptions, by reason of small numbers or otherwise, as the Commission might decide; and of dealers therein.

(*b*) The suspension or withdrawal of registration from distributing centres which, after inspection, were deemed unsuited to carry out such distribution, by reason of disease, or of the obvious unfitness of stock for breeding purposes, or of grossly unhygienic conditions; and from dealers who were consciously responsible for the distribution of stock from such centres.

(*c*) The application of such conditions of registration of hatcheries as were calculated particularly to ensure that the hatching eggs were obtained from B.W.D. free stock of reasonably good quality.

(*d*) The confirmation of registration in such manner and at such times as was deemed expedient.

(*e*) The institution of a grading scheme on voluntary lines for breeding farms, designed to secure the production of higher-quality stock, assisted by premiums from the National Exchequer.

(*f*) The formulation of a scheme for the establishment of one or more progeny-testing stations for the production of foundation breeding stock.

(*g*) The examination of the position of auction sales, with a view to laying down conditions under which stock, etc., may be sold by auction.

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(*h*) The examination, as occasion required, of the position in regard to the importation of poultry and hatching eggs into this country, from the standpoint of its possible repercussions on the problem of mortality in the home poultry industry.

The Committee also recommend increased financial provision for research into urgent problems of poultry mortality, and for educational and advisory work amongst poultry-keepers.

The total annual cost of the proposals for control is tentatively estimated at something of the order of £110,000. This figure, it is stated, should be considered in relation to the annual value of the output of the home poultry industry, which may be estimated at £30,000,000; to the loss from disease, estimated by the National Veterinary Medical Association to be over £4,000,000 per annum for adult laying-birds in England and Wales alone; and to the Committee's considered opinion, that the incidence of mortality is one of the most vital factors affecting the prosperity of the industry.

## Reviews

**Research Work into Sheep and Lamb Diseases.** By W. LYLE STEWART, M.R.C.V.S., King's College, Newcastle-upon-Tyne, 1938. 4th Report of the Management Committee. Alan Duke of Northumberland Memorial Fund.

THE object of the Fund is to commemorate in a useful and practical way the brilliant life and public services of Alan, eighth Duke of Northumberland, who died in 1930. The Executive Committee decided to found an endowment to facilitate investigation into the diseases of livestock with special reference to the diseases of sheep.

The work of the Duke's Memorial Fund is carried out by the staff of the Veterinary Branch, Agricultural Department, King's College, Newcastle-on-Tyne.

Vaccines and sera are issued to subscribers against lamb dysentery, braxy and pulpy kidney and a nicotine mixture against worms in sheep, and over 60,000 doses of this mixture have been issued in 1937. Lamb dysentery vaccine and serum and pulpy kidney serum were issued to subscribers and gave excellent results. The brochure is full of interesting and valuable information on the diseases of sheep and opens out a new field in the scientific discussion and treatment of the maladies of sheep. Good investigational work is being done and a concentration on sheep ailments which is both wide and deep is being carried out which cannot fail to bring its reward in the saving of more ovine life than has hitherto been the case. Those interested in sheep practice should get in touch with Mr. W. Lyle Stewart and read his little brochure.

The progress of the work largely depends on voluntary subscriptions and donations and these may be sent to the Honorary Treasurer, The Alan Duke of Northumberland Memorial Fund, Barclays Bank Limited, Newcastle-on-Tyne 1.

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**The Structure of the Fowl.** 2nd Edition, revised by O. CHARNOCK BRADLEY, M.D., D.Sc., F.R.C.V.S., pp. 133, 75 illustrations, OLIVER & BOYD, Edinburgh, 1938. Price 7s. 6d.

THE death of the late Principal of the Royal (Dick) Veterinary College came with such suddenness the veterinary profession was stunned, but it was felt by all who knew Dr. Bradley that there was one consolation in the fact that he died, as he would have wished, in harness. If further proof of this were required, the present publication amply justifies the knowledge that Charnock Bradley's literary and anatomical prowess were undimmed at the onset of his sudden fatal illness. As with his other anatomical textbooks Dr. Bradley's "The Structure of the Fowl" has always been considered a standard volume of incomparable value. This second edition may even be considered to surpass the first, for although re-written and incorporating new illustrations the text has not increased in size and provides delightful reading in every paragraph. Indeed, it is almost ideal for the firm concise facts are never padded, and the choice of adjectives, as was always Dr. Bradley's flair, perfect. There must therefore be something about the conjuctiva which appeals to the author's imagination more than to the average reader, for he describes it as " a delicate and exquisitely sensitive membrane "—an impression assuredly acquired from an intimate knowledge of its microscopical characters and natural functions.

The references to avian physiology throughout the book are numerous and may be considered just as accurate as any of the other of the late principal's writings. It may appear almost presumptuous to stress the specially high standard of certain of the twelve chapters of the text, but to the reviewer those dealing with the skeleton, nervous system, the skin and its appendages, and the development of the chick are supreme.

It is obviously extremely difficult to find fault with such a book, but perhaps the absence of reference to the parathyroid glands may be mentioned, as also the obturator foramen in figure 7, page 25. There is also some discrepancy between the text on page 63 dealing with the size of the testicles and the diagram on the following page. These are all, of course, minor points and do not in any way reflect on the real merit of the book.

Apparently, Dr. Bradley did not consider that the remnant of the yolk sac (to be found in the adult bird attached at a point approximately midway between the duodenum and commencement of the large intestines) was of any value in distinguishing between the jejunum and ilium for he says there is no demarcation between them.

Students of the Edinburgh College will remember that terminology and the derivation of scientific terms were always to be closely associated with the teaching of anatomy, but few will recall the resemblance between the *chalazae* and hailstones!

A separate chapter is not devoted to the endocrine glands for they are included under the circulatory system as " associated organs," and in this connection it is interesting to note that the author refers to the single thyroid gland composed of two lateral lobes. To the clinician of course there are two separate thyroid glands closely associated with the parathyroids. In view of the great importance of " eye colour " to the pedigree poultry breeder, Dr. Bradley's statement that " the yellow colour of the iris of the fowl is apparently dependent upon the presence of fat globules contained within its cells " will be of fundamental significance.

This volume must be read by everyone who studies the hen, for its facts are of essential value to the veterinarian, poultry adviser and student. Its charming style and explicit diagrams make it splendid reading for the intelligent poultry farmer, who will not, of course, expect to appreciate its beauty as fully as the pathologist, but with the help of the index it can be mastered readily by all who are interested in the biology of the hen.

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# Publishers' Notices

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